

\*\*\*\*\*  
NATIONAL AERONAUTICS  
AND SPACE ADMINISTRATION  
\*\*\*\*\*

NASA-15185 (June 2004)  
NASA  
Superseding NASA-15185  
(December 2003)  
\*\*\*\*\*

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15185

REFRIGERATION PIPING AND SPECIALTIES

06/04

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS
- 1.4 OPERATION AND MAINTENANCE

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 REFRIGERANT
- 2.3 PURGING AND TESTING NITROGEN GAS
- 2.4 BRAZING ROD
- 2.5 GASKETS
- 2.6 PIPING
- 2.7 REFRIGERANT LIQUID RECEIVER
- 2.8 PRESSURE GAGES
- 2.9 THERMOMETERS
- 2.10 SHUTOFF AND CHECK VALVES
- 2.11 SOLENOID VALVES
- 2.12 EXPANSION VALVES
- 2.13 EVAPORATOR PRESSURE REGULATORS
- 2.14 FILTER/DRYERS
- 2.15 LIQUID SIGHT GLASSES
- 2.16 MOISTURE INDICATORS
- 2.17 DISCHARGE-LINE OIL SEPARATOR
- 2.18 LIQUID-SUCTION INTERCHANGERS
- 2.19 LINE STRAINERS
- 2.20 MUFFLERS
- 2.21 PIPING SYSTEMS SUPPORTS

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 TESTING

-- End of Section Table of Contents --

\*\*\*\*\*  
NASA-15185 (June 2004)  
NATIONAL AERONAUTICS NASA  
AND SPACE ADMINISTRATION Superseding NASA-15185  
(December 2003)  
\*\*\*\*\*

SECTION 15185

REFRIGERATION PIPING AND SPECIALTIES  
06/04

\*\*\*\*\*  
NOTE: Delete, revise, or add to the text in this  
section to cover project requirements. Notes are  
for designer information and will not appear in the  
final project specification.

This section covers only the piping and specialties  
used for gases normally used in air-conditioning  
systems applications.

\*\*\*\*\*

PART 1 GENERAL

1.1 REFERENCES

\*\*\*\*\*  
NOTE: The following references should not be  
manually edited except to add new references.  
References not used in the text will automatically  
be deleted from this section of the project  
specification.

\*\*\*\*\*

The publications listed below form a part of this section to the extent  
referenced:

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 495 (1999) Refrigerant Liquid Receivers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B40.1 (1991; R 1997) Gauges - Pressure  
Indicating Dial Type - Elastic Element

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 15 (2001) Safety Code for Mechanical  
Refrigeration

ASHRAE-04 (1997) Handbook, Fundamentals (SI Edition)

ASHRAE-05 (1999) Handbook, HVAC Applications (SI  
Edition)

ASHRAE-06	(1997) Handbook, HVAC Systems and Equipment (IP Edition)
ASHRAE-08	(1998) Handbook, Refrigeration Systems and Applications (SI Edition)
ASHRAE-Hdbk SE-SI	(2000) Handbook, HVAC Systems and Equipment (SI Edition)

ASME INTERNATIONAL (ASME)

ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASTM INTERNATIONAL (ASTM)

ASTM A 278	(1993) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 Degrees F
ASTM A 278M	(2001) Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 345 Degrees C (Metric)
ASTM B 280	(2003) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM F 104	(2003) Standard Classification System for Nonmetallic Gasket Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-104	(2003) Wrought Copper LW Solder Joint Pressure Fittings
MSS SP-86	(2002) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J513	(1999) Refrigeration Tube Fittings - General Specifications Standards
----------	---

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-F-1183

(1987j) Fittings, Pipe, Cast Bronze,  
Silver-Brazing, General Specification for

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS BB-N-411

(2002c) Nitrogen, Technical

1.2 GENERAL REQUIREMENTS

\*\*\*\*\*  
NOTE: If Section 15003, "General Mechanical Provisions," is not included in the project specification, applicable requirements therefrom should be inserted and the following paragraph deleted.  
\*\*\*\*\*

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

As-Built Drawings shall be submitted for refrigeration piping systems providing current factual information including deviations from, and amendments to, the drawings and concealed and visible changes in the work.

Fabrication drawings shall be submitted for Refrigeration Piping and Accessories showing fabrication details to be performed in the shop prior to installation.

System Analysis Development Data shall be submitted showing data on accumulative operating probabilities, such as impact of accumulative tolerances on performance of the refrigeration piping system. Logic diagrams shall indicate the probability of unbalance on a system if out-of-tolerance power exists. Logic data shall depict possible failure modes, probable failure rates, and detailed system level analysis.

1.3 SUBMITTALS

\*\*\*\*\*  
NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.  
\*\*\*\*\*

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Connection diagrams shall be submitted indicating the relations and connections of the following items. Drawings shall indicate the general physical layout of all gages and regulators.

Refrigerant  
Refrigerant Liquid Receiver  
Pressure Gages  
Thermometers  
Valves  
Regulators  
Filter/Dryers  
Liquid Sight Glasses  
Moisture Indicators  
Discharge-Line Oil Separator  
Liquid-Suction Interchangers  
Line Strainers

Fabrication drawings shall be submitted for the following in accordance with paragraph entitled, "General Requirements," of this section.

Refrigeration Piping  
Accessories

Installation drawings shall be submitted for refrigeration piping systems in accordance with the paragraph entitled, "Installation," of this section.

As-Built Drawings shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-03 Product Data

Equipment and performance data shall be submitted for the following items indicating use life, system functional flows, safety features, and features such as electrical system protective device ratings.

Pressure Gages  
Thermometers  
Valves  
Regulators

Manufacturer's catalog data shall be submitted for the following items:

Refrigerant  
Gaskets  
Piping  
Refrigerant Liquid Receiver  
Filter/Dryers  
Liquid Sight Glasses  
Moisture Indicators  
Discharge-Line Oil Separator  
Liquid-Suction Interchangers  
Line Strainers  
Mufflers  
Supports  
Spare Parts

#### SD-05 Design Data

System Analysis Development Data shall be submitted for refrigeration piping system in accordance with paragraph entitled, "General Requirements," of this section.

#### SD-06 Test Reports

Test reports shall be submitted in accordance with the paragraph entitled, "Testing," of this section.

#### SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

- Refrigerant
- Gaskets
- Piping
- Refrigerant Liquid Receiver
- Pressure Gages
- Thermometers
- Valves
- Regulators
- Filter/Dryers
- Liquid Sight Glasses
- Moisture Indicators
- Discharge-Line Oil Separator
- Liquid-Suction Interchangers
- Line Strainers
- Mufflers
- Supports
- Spare Parts

#### SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

### 1.4 OPERATION AND MAINTENANCE

Contractor shall submit [6] [\_\_\_\_\_] copies of the Operation and Maintenance Manuals and Spare Parts requirements 30 calendar days prior to testing the refrigeration piping systems. Data shall be updated and resubmitted for final approval no later than 30 calendar days prior to contract completion.

## PART 2 PRODUCTS

### 2.1 GENERAL

All system materials shall comply with applicable requirements of ASHRAE 15, ASHRAE-04, Chapter 35, ASHRAE-08 and ASME B31.5.

### 2.2 REFRIGERANT

Refrigerant shall have ozone depletion potential of [0.05] [\_\_\_\_\_] or less and shall conform to ASHRAE-06 ASHRAE-Hdbk SE-SI, Chapter 32.

CFC refrigerant shall not be used.

### 2.3 PURGING AND TESTING NITROGEN GAS

Gaseous nitrogen shall be dry, conforming to FS BB-N-411, Grade A (99.95 percent pure), Type I (gaseous), with minus 70-degree F minus 57 degrees C dewpoint.

### 2.4 BRAZING ROD

Brazing material shall be AWS Type BCuP-5.

### 2.5 GASKETS

Gaskets shall be formed from compressed non-asbestos fiber material sheet conforming to ASTM F 104, both sides shall be free of any lubricant and shall contain not less than 75 percent non-asbestos fiber material.

### 2.6 PIPING

Type CPR-ACR-Copper air-conditioning Refrigeration Piping shall be as follows:

#### Tubing:

To 7/8-inch outside diameter (od)	Annealed Type K, conforming to ASTM B 280, where bending or flare connection is required
Over 7/8- inch od	Hard-drawn, seamless-copper tubing con- forming to ASTM B 280, No. C12200

#### Fittings:

To 7/8-inch od	Flared-type, conforming to SAE J513
Over 7/8- inch od	150-pound per square inch, gage (psig), wrought-copper socket-joint, conform- ing to ASME B16.22

All fitting cup depths and tolerances  
shall conform to MS MIL-F-1183.

To 22 millimeter outside diameter (od)	Annealed Type K, conforming to ASTM B 280, where bending or flare connection is required
Over 22 millimeter (od)	Hard-drawn, seamless-copper tubing con- forming to ASTM B 280, No. C12200

#### Fittings:

To 22 millimeter (od)	Flared-type, conforming to SAE J513
Over 22 millimeter (od)	1050 kilopascal, wrought-copper socket- joint conforming to ASME B16.22, MSS SP-104, and MSS SP-86

All fitting cup depths and tolerances  
shall conform to MS MIL-F-1183,  
and MSS SP-86

\*\*\*\*\*  
**NOTE: Select following text if expansion and  
vibration isolation provisions are not specifically  
indicated. Refer to Section 15072, "Vibration  
Isolation for Air Conditioning Equipment."**  
\*\*\*\*\*

Flexible connectors:

All sizes: Flexible connections for reciprocating equipment shall be the seamless, corrugated, all nonferrous-metal type with external nonferrous metal reinforcing braid. Flexible connections shall be installed in pairs, one at right angle to the other, whether shown or not. Working pressure rating shall have 4 to 1 safety factor at minimum.

## 2.7 REFRIGERANT LIQUID RECEIVER

\*\*\*\*\*  
**NOTE: The following covers remote receivers for  
process or comfort air-conditioning systems.**

**Delete receiver or provide bypass valving if  
subcooling is required or when head pressure control  
is used.**

**Drawings or schedule must show size, piping  
diagrams, etc.**  
\*\*\*\*\*

Refrigerant liquid receiver shall have all necessary openings, accessories, and support provisions.

Receiver shall conform to ARI 495, ASHRAE-06 and ASHRAE-05, ASHRAE-08 and ASME BPVC SEC VIII D1.

Pump-down capacity of receiver shall be 80 percent of the internal volume of the receiver.

Receiver shall be equipped with inlet-outlet drop pipe, drain plug, purging valve, relief valves of capacity and setting required by ASHRAE 15, and two bull's-eye liquid-level sight glasses. Sight glasses shall be in the same vertical plane, 90 degrees apart, perpendicular to the axis of the receiver, and not over 3 inches 75 millimeter horizontally from the drop pipe, measured along the axis of the receiver. In lieu of bull's-eye sight glass, external gage glass with metal glass guard and automatic-closing stop valves may be provided.

## 2.8 PRESSURE GAGES

Refrigerant pressure gages shall conform to requirements specified under Section 15050, "Basic Mechanical Materials and Methods," except that gages shall be in conformance with ANSI B40.1, Class 1, Style X, Type III, minimum 3-1/2 inch 90 millimeter size.



## 2.9 THERMOMETERS

Thermometers shall conform to the requirements specified under Section 15050, "Basic Mechanical Materials and Methods." Dial, remote or direct-bulb adjustable-angle type, is acceptable provided case is corrosion-resistant steel, not less than 3-1/2 inches 90 millimeter in diameter, and accuracy is plus or minus 1 degree 0.5 degree, graduated in 2-degree 1-degree increments. Dial face shall be white with black digits. Thermometers shall be installed in copper wells.

## 2.10 SHUTOFF AND CHECK VALVES

Valves shall conform to ASHRAE-06 ASHRAE-05, Chapter 42. Shutoff valves shall be packless diaphragm (in sizes commercially available), with packed, ground-finish stem, key operated, back seating, sealed-cap type; otherwise, angle pattern valves shall be used whenever possible. Check valves shall be lift type for gases and vapors and swing-check type for liquids.

Valves connected to copper tubing shall have flared end connections up to 7/8-inch 22 millimeter od and [socket type ends] [flanged ends] with flange adapters for all other sizes.

## 2.11 SOLENOID VALVES

Valves shall be brass or steel body, packless type, with corrosion-resistant steel trim, rated for continuous-duty service, direct-or pilot-operated, provided with manual lift stems, and designed for use with type of refrigerant used. Valve capacities shall be sufficient for the requirements of the installation at a pressure drop not in excess of 2 pounds per square inch (psi). 14 kilopascal. Valves in suction lines shall be sized in accordance with temperature rise and superheat normal to the system.

Valves connected to copper tubing shall have flared-end connections up to 7/8-inch 22 millimeter od and [socket type ends] [flanged ends] with socket flange adapters for all other sizes.

## 2.12 EXPANSION VALVES

Valves shall be thermal-expansion type to suit specific system refrigerant, designed to fit coil distributors, and capable of operating from 40 to 100 percent of full load at system head pressure without hunting or liquid hammer. Valves shall have external equalizer connections and external superheat adjustments with seal caps. Joint connections shall be [mechanical threaded] [flanged type]. Valves shall require not over 4 degrees F 2 degrees C superheat change to move from fully open to fully closed position. Superheat setting shall be 10 degrees F minus 12 degrees C at full load.

Expansion valves shall be balanced [double-seated] [pilot-operated], capable of stable operation at 15 percent design load.

Each valve shall be provided with external strainer.

Manual-angle, globe body expansion valves shall be provided in three shutoff-valve bypasses to facilitate automatic valve maintenance.

## 2.13 EVAPORATOR PRESSURE REGULATORS

Evaporator pressure regulators shall have a maximum pressure drop at design conditions of 3 psi 21 kilopascal with refrigerants R-22 or R-502. Regulators shall be installed with valved gages upstream and downstream and shall be fully adjustable, both for setting and for throttling range from open to closed.

## 2.14 FILTER/DRYERS

Filter/dryers, in sizes 1/2 inch 13 millimeter and larger shall be the full-flow, replaceable-core type. Sizes smaller than 1/2 inch 13 millimeter shall be the sealed type. Cores shall be of a suitable desiccant that will not plug, cake, dust, channel, or break down but shall remove water, acid, and foreign material from the refrigerant. Dryer shall be constructed so that no desiccant will pass into the refrigerant lines. A filter/dryer shall be provided in the liquid line to each evaporator and shall be piped with a three-valve bypass. Pressure drop through the dryer shall not exceed 2 psi 14 kilopascal when operating at full connected evaporator capacity.

## 2.15 LIQUID SIGHT GLASSES

Sight glasses shall be double glass, see-through type, with cover cap on each side. Sight glass shall be provided in liquid line immediately preceding each expansion valve. Glass shall be furnished with a color-change-type moisture indicator.

## 2.16 MOISTURE INDICATORS

\*\*\*\*\*  
**NOTE: Can be used on liquid lines, receivers, access valves, tees, or unions, 1/4-inch 6M SAE thread type may be provided with valve depressor to open stem on access valve. Can be included in the sight glass.**  
\*\*\*\*\*

Color-change moisture indicators shall be [provided downstream from each filter/dryer and bypass] [combined as a single unit in the liquid sight glasses].

## 2.17 DISCHARGE-LINE OIL SEPARATOR

Discharge-line oil separator of rated capacity equal to or greater than the compressor capacity shall be provided in the discharge line from each compressor when recommended by the compressor manufacturer for the specific installation. Separator shall be provided with [an oil float-valve assembly] [needle valve and orifice assembly], drain-line shutoff valve, and sight glass. Oil-return line shall be connected to the compressor as recommended by the compressor manufacturer.

## 2.18 LIQUID-SUCTION INTERCHANGERS

Liquid-suction interchangers shall be provided to increase system efficiency to subcool liquid refrigerant or to prevent liquid refrigerant from entering the compressor.

## 2.19 LINE STRAINERS

Strainers shall be Y-type with removable basket. Strainers in sizes 2-inch DN50 iron pipe size (ips) and smaller shall have solder ends; in sizes 2-1/2-inch DN65 ips and larger, strainers shall have flanged ends. Minimum body working-pressure rating shall be 250 psig 1750 kilopascal. Body shall have cast-in arrows to indicate direction of flow. All strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Body material shall be cast bronze, conforming to ASTM B 62, in sizes 2-inch DN50 ips and smaller, and cast bronze or cast iron conforming to ASTM A 278 ASTM A 278M, Class 30, in sizes 2-1/2-inch DN65 ips and larger.

Minimum free-hole area of strainer element shall be equal to not less than 5 times the internal area of connecting piping. Strainer screens for liquid service shall have perforations not to exceed 0.010 inch 0.25 millimeter (or equivalent wire mesh). Strainer screens for vapor or gas service shall have perforations not to exceed 0.02 inch 0.51 millimeter or equivalent wire mesh. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be [AISI Type [304] [316] corrosion-resistant steel] [Monel metal].

## 2.20 MUFFLERS

A muffler shall be provided in hot-gas discharge line.

## 2.21 PIPING SYSTEMS SUPPORTS

Piping systems support materials shall conform to requirements specified under Section 15050, "Basic Mechanical Materials and Methods," requirements specified herein, and, where not in conflict, the requirements of ASHRAE-04, Chapter 35, ASHRAE-08, ASHRAE 15 and ASME B31.5.

Supports for uninsulated copper tubing shall have wide copper-plated bearing surfaces with lead sheet liners between the tube and the support in the contact area, which shall be secured to the support by turned-under edges.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Equipment shall be installed in accordance with manufacturer's recommendations and in accordance with Section 15050, "Basic Mechanical Materials and Methods."

### 3.2 TESTING

Testing of system shall be performed in accordance with manufacturer's recommendations and Section 15950, "Testing, Adjusting and Balancing."

-- End of Section --